STAFF REPORT

THE GRASSLAND BYPASS PROJECT
Status Report

The Board's Basin Plan calls for annual review of the program to control discharges of selenium to the lower San Joaquin River. Selenium is a naturally occurring element found in soils and ground water in several portions of the watershed and the Grassland Bypass Project (GBP) was set up to manage discharges of selenium and other constituents in agricultural subsurface drainage from approximately 97,000 acres of cropland in Fresno and Merced Counties. The goal is to protect wetland water supplies and to reduce discharges over time to meet water quality objectives in the San Joaquin River.

The project participants include the US Bureau of Reclamation (Bureau), which owns the San Luis Drain, and the San Luis Delta Mendota Water Authority (SLDMWA), which consists of water and drainage authorities in and around the Project area. The project operates under Waste Discharge Requirements (WDRs) Order No. 5-01-234.[1] A number of other State and Federal authorities play various roles in the project.

This report provides a brief history of the events leading up to the Project and the status of the Project today. This report will also discuss various complementary projects within the GBP area and issues that have arisen since the last update to the Board. The report will conclude with a summary of events and activities expected to occur in the next five years and recommendations for revisions to the Project's Monitoring and Reporting Program.

BACKGROUND

The project area is located on the west side of the San Joaquin River Basin in Merced and Fresno counties, roughly bounded by Interstate 5 to the west and the San Joaquin River to the east. The regulated drainage area is south of Highway 152 and the City of Los Banos and north of Westlands Water District. A Drainage Activity Agreement has been set up among the water users in the project area, the Grassland Area Farmers (GAF). The GAF manage the discharge of drain water for the Bureau and the SLDMWA, the Dischargers named in the WDRs. The entities that make up the GAF are Charleston Drainage District, Pacheco Water District, Panoche Drainage District, Broadview Water District, Firebaugh Canal Water District, Widren Water District and Camp 13 Drainage District.

A Use Agreement has been established to allow the SLDMWA to use a portion of the San Luis Drain, a federal facility. The Use Agreement establishes committees that assist in the monitoring and evaluation of the project's performance. Board management and staff participate on these committees along with representatives of the Bureau, the GAF, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, U.S. Geological

[1] Waste Discharge Requirements for the Grassland Bypass Project (Phase II), 2001

Survey and the California Department of Fish and Game. All of the involved agencies participate in monitoring and preparation of annual reports.

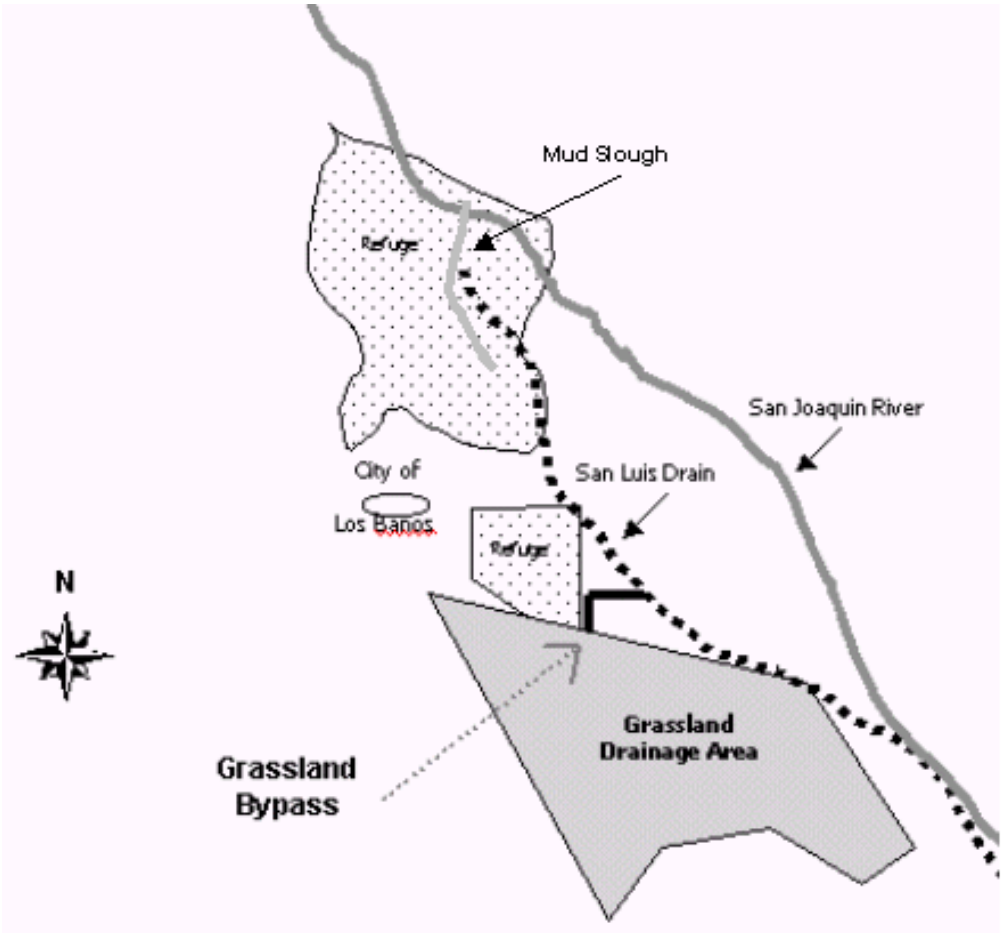


Figure 1

In the 1980s, selenium in irrigation subsurface drainage was determined to be the cause of teratogenic deformities in waterfowl at the Kesterson National Wildlife Refuge in Merced County. This led to the closure of the ponds at the refuge and a region-wide evaluation of selenium levels in irrigation return flows. This work determined that subsurface drainage from the area now served by the Grassland Bypass Project was high in selenium. At the time, the drainage from this area flowed through a major wetland area to the San Joaquin River.

The Board adopted Basin Plan amendments in 1988 and again in 1996 containing control programs to reduce the discharges of selenium to wetland areas and the San Joaquin River. The goal of the 1996 amendment was to (1) promptly remove high-selenium agricultural subsurface drainage from channels supplying water to the wetlands that serve as waterfowl habitat and (2) establish a timetable for meeting the 5 µg/L water quality objective in the San Joaquin River.

The GBP has been operated to comply with the Basin Plan. Agricultural subsurface drainage flows from a number of water agencies have been consolidated and are routed through sensitive wetland areas in the San Luis Drain for discharge to Mud Slough, a tributary of the San Joaquin River. Prior to the project, this drainage flowed through channels that also delivered water to wildlife refuges and this had exposed sensitive waterfowl to high levels of selenium.

The WDRs also implement the Total Maximum Monthly Load (TMML) for selenium adopted by the Board to bring concentrations in the San Joaquin River into compliance with water quality objectives. The amount of selenium that can leave the drainage area is restricted under the WDRs, varying by WY type. Beginning this October, the limits shrink each year through 2009, as shown below.

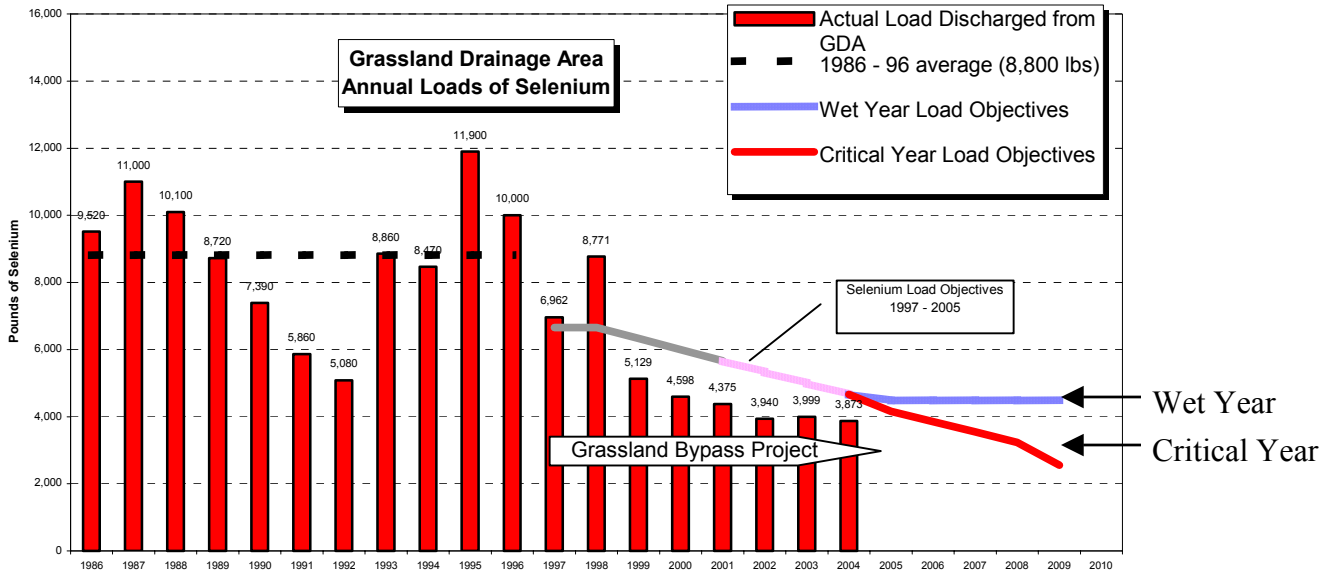


Figure 2

PROJECT PERFORMANCE

The GBP went into operation in 1996, shortly after the Board adopted its Basin Plan amendment addressing selenium, and WDRs were first adopted in 1998 after the amendment received final approval. The project serves 97,000 acres of cropland and discharged 27,700 acre-feet of drainage water in water year 2004 (see Figure 3). The WDRs for the project state "*During water year 2000, releases from the* (San Luis) *Drain contributed 97% of the selenium, 55% of the boron, 36% of the salt and 13% of the volume of water discharged to the San Joaquin River from the Grassland Watershed.*" While the project was established to address selenium, staff expects that the Board's salt and dissolved oxygen TMDLs for the San Joaquin River will result in additional limits on discharges in the future.

Overall, the load limits have been generally met, and selenium concentrations, while not always meeting performance goals, have been consistently and significantly lower than

pre-project conditions. Mud Slough is the exception, as this water body is used to convey drainage from the end of the San Luis Drain to the San Joaquin River.

Selenium concentrations in Salt Slough dropped quickly and remained low, a pattern that was echoed at other wetland water supply monitoring points (see Figure 4). As noted below, periodic exceedances of objectives in some of these water bodies are still being investigated.

Figure 3

Grassland Bypass Project
Monthly Discharge in Acre-feet
Water Year 2004

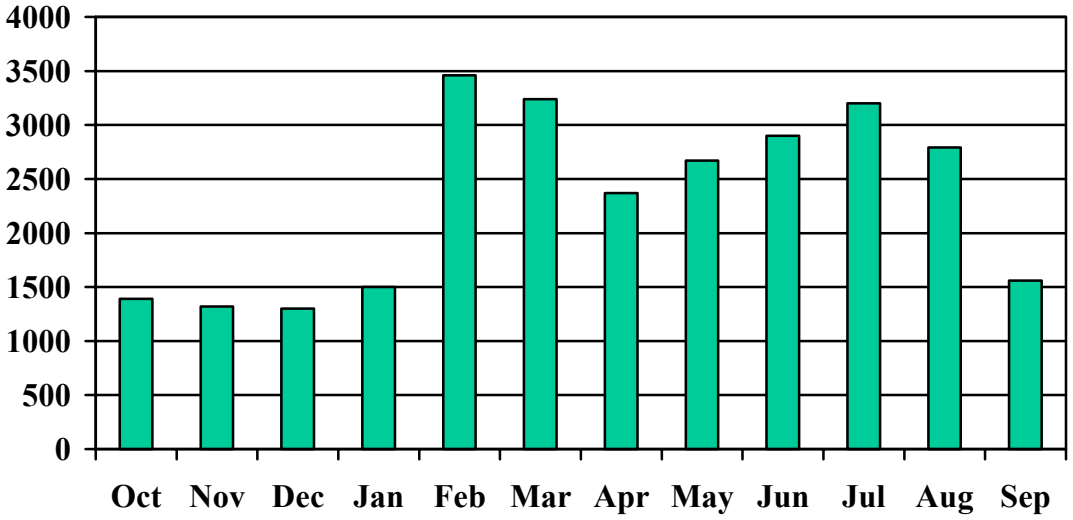
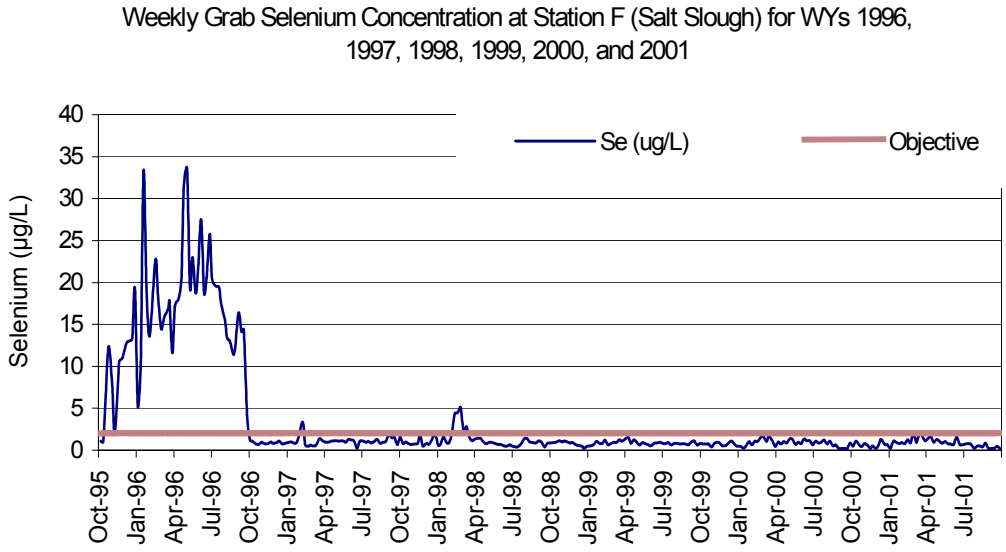


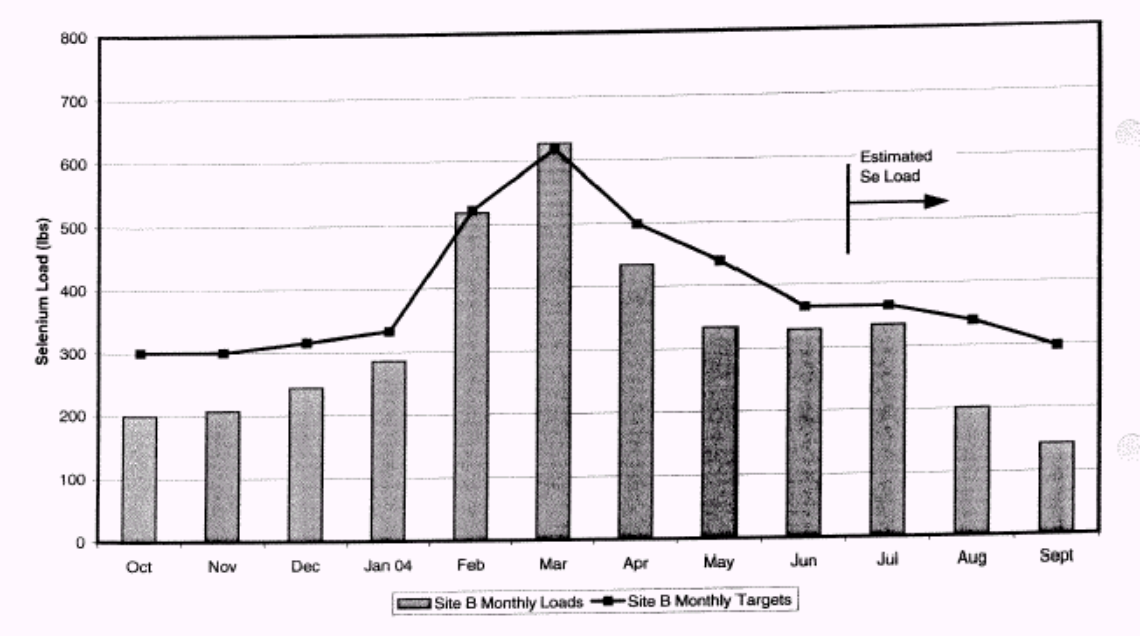
Figure 4



EXCEEDANCES

While selenium is exhibiting an overall downward trend, there are instances where load limits and/or performance objectives have been exceeded, particularly in February and March during the spring pre-irrigation season. Pre-irrigation is application of water to cropland prior to planting a crop. It is a technique used by farmers to insure that there is sufficient soil moisture available to establish a crop early in the growing season. These applications are made following the winter rains and at a time when there are few crops to reuse the drainage generated. These conditions historically translate to an annual peak in selenium concentrations in monitored channels and selenium loads discharging from the basin as shown below (Figure 5)

Figure 5[2]
Monthly loads discharged in 2004



The table above was taken from the annual report prepared by the GAF for 2004. It shows the loads discharged last year, when relatively normal conditions prevailed. The pre-irrigation season falls roughly between February and April. You will notice the load limit in March was exceeded slightly (9 pounds). The GAF were asked to prepare a strategy for avoiding future spring exceedances and have responded with the following:

- EDUCATION & OUTREACH - In November 2004, the GAF held an outreach meeting with area growers to discuss the impact of pre-irrigation on drainage volume and selenium loads.

[2] Joe McGahan, Update of Long Term Drainage Management Plan, 31 December 2004.

- INCREASE CAPACITY – The GAF operate a drainage reuse area (SJRIP). Current plans are underway to expand and further develop the area through installing pumps, tile lines and other infrastructure elements. While the SJRIP is primarily designed to accept drainage during the irrigation season, some excess drainage can be diverted to this area during the pre-irrigation season.

- LAND RETIREMENT – One member of the GAF, Broadview Water District, has recently been purchased by Westlands Water District (WWD) for the purpose of transferring their Central Valley Project water allocation to WWD. As a result, Broadview will no longer be irrigated.[3]

- TEMPORARY FALLOWING – In addition to Broadview going out of irrigated agricultural production permanently, approximately 3,900 acres in the Project area are expected to undergo temporary fallowing.

Ongoing investigation

Project monitoring has included wetland channels that should now be free of high-selenium agricultural subsurface drainage. Selenium in the San Luis Canal and other channels periodically exceeds the 2 µg/L monthly mean water quality objective (Figure 6). A 2000 Staff Report identified two drainage areas where selenium could be entering wetland channels from outside project boundaries, and a number of other potential sources, including tail water (surface water) runoff from irrigation and local groundwater seepage.[4] Some sources have been identified and these discharges have been reduced, but as the GBP moves forward, these sources will need to be investigated further.

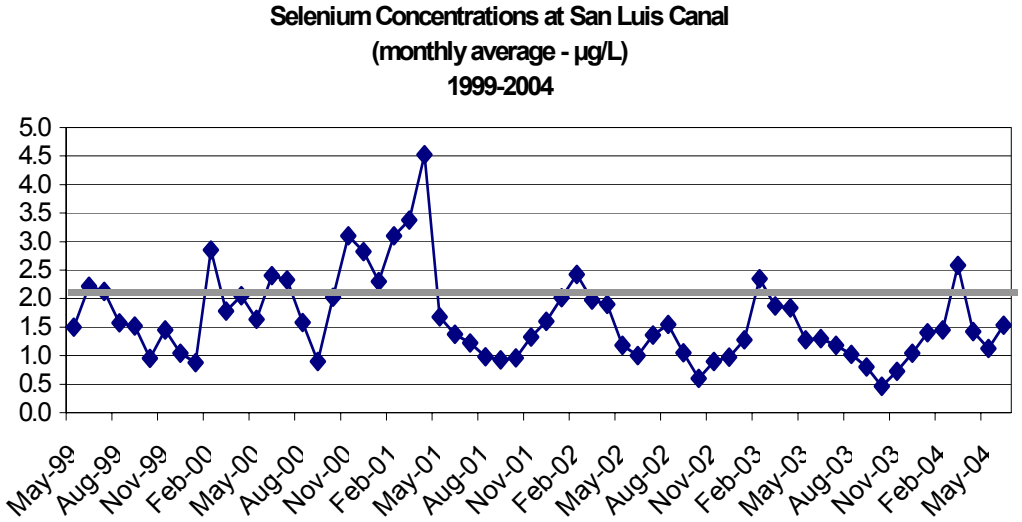


Figure 6

[3] A small portion (approximately 200 acres) may continue to receive water.

[4] Jeanne Chilcott, Staff Report: *Review of Selenium Concentrations in Wetland Water Supply Channels*, 28 April 2000

EMERGENCY STORMWATER PLAN

The GBP was designed to handle agricultural drainage, but in 1997 and again in 1998 the region experienced extraordinarily high rainfall. The project area flooded and selenium loads moving through the system and into the wetlands and San Joaquin River were high. The GAF adopted a storm event emergency plan containing a series of steps that the dischargers undertake during severe storms. Agricultural drainage pumps are turned off and downstream water managers are notified that flood flows exceeding the capacity of the Bypass Channel will be sent down the historical drainage channels. Storm event monitoring is conducted. In addition, the USGS was commissioned by the Bureau to look at source control to minimize selenium discharges during storm events. USGS is developing a model but at this writing, the task has not been completed. However, a preliminary document was released last year: *Estimation of a Water Budget for 1972-2000 for the Grasslands Area, Central Part of the Western San Joaquin Valley, California*.[5]

In 2005, the Project area experienced torrential rainfall in short bursts, causing the operators to implement their emergency stormwater plan for one week to prevent damage to the San Luis Drain and other key channels.[6] Data is still being collected and analyzed but Staff anticipates that the load limits will be exceeded during February and possibly into March for 2005.

SAN JOAQUIN RIVER WATER QUALITY IMPROVEMENT PROJECT

The San Joaquin River Water Quality Improvement Project (SJRIP) uses drainage water for crop production as a means of reducing discharges to the river. It is operated by Panoche Drainage District, the largest cooperator within the Project area, and consists of approximately 4,000 acres of cropland purchased through a $17.5 M grant. Subsequent grants have helped fund development of the drainage reuse area, expanding the existing tile drainage system, installing additional pumps and valves and planting various salt tolerant forages and other plants.

Most of the developed SJRIP acreage is devoted to salt-tolerant forage crops. Bermuda, "Jose" tall wheat grass, alfalfa, and other common grasses are grown and the pastures are leased for grazing cattle and goats, providing a small income stream to offset some of the operational costs. The SJRIP also has small fields devoted to more experimental or labor-intensive crops (pistachios, asparagus, halophytes, etc) but these are operated primarily as demonstration plots. At the present time, only about 1,800 acres are fully developed, but significant amounts of salt, selenium, and other constituents in drainage have been diverted to the area.

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[5] USGS, *http://water.usgs.gov/pubs/sir/2004/5180/*

[6] On 25 February 2005 the GAF reported that between February 14 & 16, the Grassland Drainage area received 1.6" of rainfall, to bring their monthly total up to 2.45". Flow measured at Site A where drainage normally enters the San Luis Drain, was observed at 159 cfs. The Drain is not designed to carry flows in excess of 150 cfs.

By using drainage to grow crops and halophytes, the district reduces the volume discharging through the San Luis Drain. This translates to a reduction in selenium and other constituents leaving the Project area and an increase in constituents sequestered in soil and plant biomass. This is not a sustainable solution over the long term and a future phase is planned that will allow the GAF to remove and dispose of salt, selenium and other pollutants from the SJRIP. Options under consideration include evaporation basins, solar evaporators, solar ponds and other variations on disposal facilities. Selenium treatment research has been performed since the project's inception, and those options continue to be explored. There is still no clear preferred option for dealing with the final phase of the SJRIP at this writing. The Bureau of Reclamation, as part of it's drainage feature reevaluation of the San Luis Unit, is considering in-valley drainage management options as a means for the Bureau to comply with a court order to "immediately" supply drainage service to the area south of the GBP.[7] It is likely that the GAF will not select a plan for ultimate disposal of pollutants until they have an idea of how the Bureau intends to deal with it's drainage obligations. Project proponents indicate that operation of the SJRIP could continue for a number of years before salt impacts will severely limit production of forage crops.[8]

The operation of the SJRIP leads to conditions that must be carefully managed in order to protect wildlife. The GBP is within the Pacific Flyway, and wildlife refuges are nearby (see Figure 1). As previously stated, waterfowl are particularly vulnerable to the teratogenic effects of selenium poisoning. Biological monitoring has been conducted in the SJRIP since 2001 to verify that although the SJRIP stores selenium in its fields and crops, selenium is not adversely affecting birds frequenting the area. Soil- and crop-borne selenium is only likely to pose a problem when birds stay onsite for an extended period and restrict their foraging to the immediate neighborhood.

In 2003, a series of events led to a worst-case scenario in one field within the SJRIP. A channel broke and an inexperienced district employee did not immediately act to resolve the problem (in a normal farming operation, field flood-up is inconvenient but not usually a cause for major alarm). Water collected in one end of the field and remained for several weeks (late April through mid-May) during the nesting season. Eggs were collected, as they have been since 2001, but because there was standing water present, more nests were observed than had been in previous years. These eggs were found to have selenium at concentrations similar to egg concentrations found in Kesterson years earlier. Subsequent conversations with US Fish & Wildlife Service confirmed that at these concentrations, embryo viability would be severely compromised. A "take" had occurred.[9]

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[7] USBR, San Luis Drainage Feature Re-evaluation Environmental Impact Statement Scoping Report, July 2004

[8] Chris Linneman, Summers Engineering, personal communication, 3 September 2003

[9] Joe Skorupa, USFWS, personal communication, 22 November 2004

After the consultant conducting the biological monitoring reported to the GAF, the GAF immediately contacted this office and members of the Data Collection and Reporting Team (DCRT), a multi-agency committee that oversees and coordinates all monitoring in the Project area. The district field crew was instructed in the importance of allowing no standing water in the SJRIP at any time and a memo was submitted to Staff that discusses the 2003 event and steps that have been taken to prevent a recurrence. These steps include operating to avoid standing water (reiterating a requirement that has been in effect since the project onset), pumping any occurrences of standing water within 24 hours, instructing operators within the SJRIP to stop irrigation before water reaches the end of the field and leveling the low spot in the field that flooded in 2003. [10]

OTHER DRAINAGE AND SELENIUM MANAGEMENT PROGRAMS

To date, approximately $40 million has been spent on drainage management in the Project area. The SJRIP is only one method of drainage and pollutant management in use. A number of studies and pilot projects have been undertaken over the years. Additionally, since selenium transport in this instance is primarily a water movement issue, the GAF utilize several different strategies for source control and drainage manipulation aimed at reducing external discharges. A 2004 report compiled by Summers Engineering details the following strategies and projects:[11]

Currently in use

- Recirculation: Drainage is put back into the irrigation distribution system and distributed as blended irrigation water

- Irrigation Improvements Loan Program: District-managed low interest loan programs for irrigation efficiency improvements

Past, ongoing & planned investigations

- Algal-Bacteriological Selenium Removal facility (ABSR): currently in pilot scale, this project attempts to utilize the natural ability of native bacteria and algae to reduce selenate to selenite, and ultimately to elemental selenium, which can be removed from the water column. It is operated by researchers from Lawrence Berkeley National Labs.

- AB-MET bacterial treatment: Also in pilot scale, this project will utilize selected strains of bacteria to transform selenium to less bioavailable species. The bacteria are first screened for effectiveness under local conditions before the reactor is inoculated. A private consultant will operate the reactor.

- Reverse Osmosis: two pilot treatment plants have been built but are not currently in operation. The technology shows promise, but there have been problems with membrane scaling & the ability for this technology to be cost effective given the

[10] Joe McGahan, correspondence, 27 January 2005

[11] Summers Engineering, Grassland Drainage Area In-Valley Drainage Solution Projects Summary Brief, October 2004, and supplement, 9 March 2005

volume of drainage that would require treatment, the infrastructure changes necessary to route drainage to a treatment facility, and disposal of the resultant brine.

- Broadview Water District Reuse Facility: Some of the BWD acreage will be dedicated for a reuse project similar to the SJRIP

- More Irrigation Improvements: The GAF are seeking approximately $20 M to fund more irrigation improvements, hoping to reduce drainage production by 5,700 AF/Y.

- Deep Groundwater Pumping: Pumping water from the deep aquifer is expected to reduce the volume of drainwater produced. The GAF are seeking $12M to fund this option.

PROJECT TRACKING

Staff are tracking a number of issues related to this discharge, including:

- The Use Agreement for the GBP expires in 2009 and effective 1 October 2010 discharges of subsurface drainage to Mud Slough are prohibited unless receiving water quality objectives for selenium are met.

- Beginning this year, selenium load limits in the WDRs vary by water year type and become progressively smaller through the end of 2009. The GAF have made outstanding progress to date in limiting discharges of selenium. However, reducing loads further will require significant effort.

- The Bureau of Reclamation is conducting a San Luis Unit Drainage Feature Reevaluation to determine the best approach for providing drainage service. The Bureau expects to circulate a draft EIS on this project in May and adopt a final EIS in July of this year. The San Luis Unit does not include GBP lands, but the Bureau has decided to address this contiguous northern area at the same time that it deals with lands further south (notably, Westlands Water District); thereby taking advantage of the progress the GBP has already made. The Bureau's decisions will undoubtedly carry some weight in the GAF's planning and drainage management actions in the future.

- U.S. EPA is developing updated criteria for selenium in California surface waters. This project will not be completed for several years.

- The GAF have asked staff to evaluate potential changes to the WDRs to bring the discharge limits more in line with conditions in the Use Permit.

All of these factors taken together make it clear that the situation today is different from the drainage management strategy that will be in place five years from now. Staff continues to monitor the situation closely.

PROPOSED REVISIONS TO THE MONITORING AND REPORTING PROGRAM

A revised Monitoring and Reporting Program (MRP) has been prepared for Board consideration. The proposed changes are minor and primarily consist of the following:

- Moving the flow measuring location from the site where water samples are collected (Site B) to the terminus of the San Luis Drain
- Requiring collection of daily composite samples at San Joaquin River at Crow's Landing (Site N) for selenium, boron and electrical conductivity analyses.
- Requiring visual inspection of the Charleston Drain on a weekly basis.
- Conducting analyses for total phosphorus rather than phosphate.
- Changing the frequency of nutrient data reporting (monthly to annually).
- Updating Attachment 1, adding clarifications to reporting limits and replacing settleable solids with Total Suspended Solids.

The US Geological Survey has evaluated the flow measurements taken at both the drain terminus and the location where water samples are taken (Site B) and determined that there are advantages to the terminus location. The additional monitoring on the San Joaquin River and Charleston Drain reflects what is being done already and the change in nutrient data submittal date reflects the fact that this data is not available within a month of sample collection.

RECOMMENDATIONS AND OVERALL PROJECT PERFORMANCE

Staff recommends that the Board adopt changes to the revised Monitoring and Reporting Program for the GBP as described above.

This report has highlighted some problems and concerns; but taking a step back, the larger picture is that this project is performing as intended. Selenium discharges to the wetland areas and the San Joaquin River have decreased dramatically. When specific problems have come up, the GAF have notified Staff in a timely manner and have responded promptly to Staff requests. There are issues that have yet to be resolved but the GBP is on track to maintain Project success through the termination date of the Use Agreement in 2009.